BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

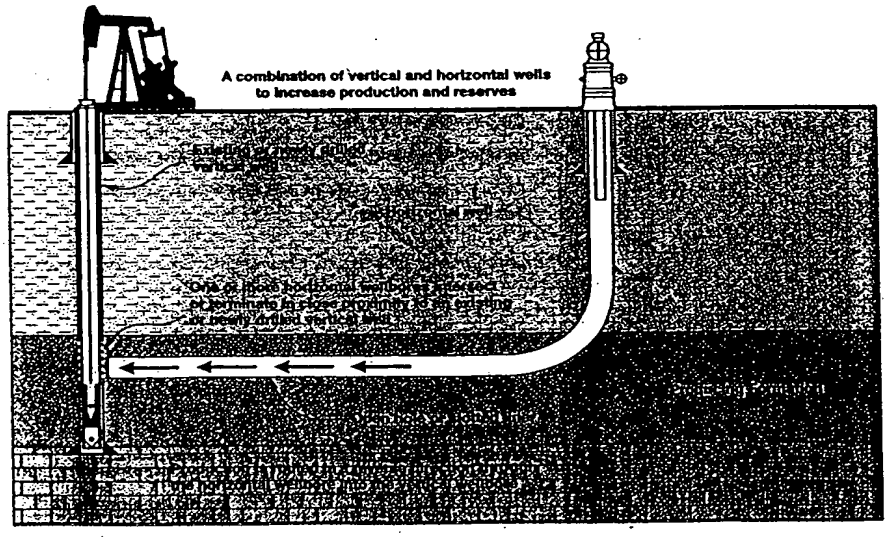
horizontal reversal

Vertical And Horizontal Well Hybrid Offers Longer Field Life

Armed with patents for Canada and the United States, Calgary-based Vertizontal Energy Resources Inc. is poised to reverse conventional production practices in mature fields by introducing a unique configuration of closely-spaced vertical and horizontal boreholes. Just as the name suggests, Vertizontal represents the best of both worlds — it's a hybrid production method employing both vertical and horizontal wellbores drilled to intersect each other in the reservoir.

Using a series, or grid, of long-reach horizontal wells, Vertizontal is designed to boost recovery factors in oilfields by tapping into new reserves that haven't been drained by vertical wellbores or swept by water or solvent floods. The introduction of Vertizontal production methods may extend the lives of fields, raising the bar on how the industry defines mature fields.

The Vertizontal production method contemplates two scenarios: The patents describe the drilling of one or more horizontal wells to penetrate the producing formation near an existing vertical wellbore. Conversely, the patents describe the drilling of a vertical wellbore to intersect the reservoir near one or more existing horizontal wellbores. In both scenarios, conventional production practices are reversed — instead of the hydrocarbons being pumped up the horizontal wellbores to the surface, the Vertizontal configuration routes the hydrocarbons to the nearby vertical wellbores where they either flow or are pumped to the surface. In the optimum configuration, the vertical borehole extends to a depth greater than its intersection with the horizontal wellbores in the producing zone, effectively forming a sump for the collection of fluids (hydrocarbons and water).



"It's not new technology," insists Nick Baiton, Vertizontal's president and inventor of the concept. "But it's the idea that you're producing in the opposite direction."

Baiton describes how the Vertizontal method could enable a horizontal well to produce continuously into an adjacent vertical wellbore while downhole testing operations are being conducted in the borehole (testing equipment enters from the surface end of the horizontal well). The advantage of this dual-functionality, says Baiton, is that there's no downtime or lost production associated with well testing. He also suggests that the Vertizontal configuration of vertical and horizontal wells can be applied in the beginning stages of field development, increasing recoveries of primary reserves.

The term "mature" field is a moving target for Baiton. During his 40-year-career as a production and drilling engineer, he has always questioned why oil companies are satisfied with a 10-25% recovery of the original oil in place. "Using Vertizontal to resurrect old vertical wells would be tremendous for the oil industry," he says. "To me, it's a crime that more oil in place is not recovered."

Baiton cites several other benefits of Vertizontal. Because multiple horizontal wells can be drilled from the same pad, costs associated with surface lease construction and equipment (such as flow lines) are reduced, and the environmental footprint mitigated. Costs are also reduced because Vertizontal takes advantage of existing vertical boreholes for production. The Vertizontal wells, therefore, only require open-hole completions or slotted well liners in the producing zone. According to Baiton, the Vertizontal wells don't require "downhole jewelry"— the expensive rod or submersible pumps used in horizontal wells to move the hydrocarbons around the corner and up to the surface.

Through serendipity, some operators in Western Canada have provided real-life analogues for the Vertizontal production method. During the past decade, Husky Oil Operations Limited has drilled numerous horizontal wells to enhance oil recovery and to reduce gas coning in mature fields. In a 1994 paper published for the Canadian SPE/CIM/Canmet International Conference on Recent Advances in Horizontal Well Applications, Husky described the unexpected benefits of drilling one horizontal well into its Rainbow Keg River E Pool in northern Alberta — output from the adjacent vertical boreholes increased by 10-15% and gas coning around the adjacent offset vertical wellbores was reduced. Concluded Husky: "The main reasons for such positive effects on offset vertical

wells are likely due to improved drainage along with healing and/or reduction of gas coning tendency at the vertical wells caused by the pulling effect of the horizontal well and/or cross flow along the horizontal borehole into the area near the vertical well(s)."

Frank McIntyre, asset manager of Husky's Rainbow Lake team, is one of the authors of the 1994 paper. "I think that Vertizontal's got potential in very specific situations," he says, and describes Vertizontal's use of horizontal wells as "a permeability enhancer." McIntyre suggests that Vertizontal may not represent a viable option for many densely-drilled, mature fields nearing the end of production: "I think in Western Canada, the light oil reservoirs may be beyond their lifetime." He envisions future Vertizontal applications in heavy oil production, and in the offshore, where Vertizontal could reduce the number of expensive wells needed to produce a reservoir.

McIntyre sees Vertizontal working "as long as there are no problems in terms of competitive drainage." Development rules in Western Canada stipulate that wellbores be no closer than 100 to 200 metres in the producing zones, depending on the field. Operators, however, can apply for relaxation of these rules.

"Horizontals work only if you understand the geology," says McIntyre. In most cases, three-dimensional seismic data are required to steer the drilling trajectories, keeping the horizontal wellbore within the producing zone. A horizontal wellbore can produce two to five times as much as a conventional vertical wellbore. That's because hundreds of metres of the reservoir may be open for production as opposed to perhaps tens of metres in a vertical wellbore. McIntyre says, however, that a horizontal well costs 1.5 times as much to drill as a conventional vertical borehole. "People are accepting horizontal technology," he says. "If they can justify it economically, they'll do it."

Baiton freely admits that not every field is a candidate for horizontal or Vertizontal drilling. He has literally looked at dozens of fields that he feels are ideal candidates for the Vertizontal production method. So what does the right dance partner look like for Vertizontal? According to Baiton, it could either be a new or mature oilfield with sufficient space to place a series of horizontal wellbores among the existing vertical wells. Perhaps the field contains wells that are candidates for abandonment. The field could be currently uneconomical; it might be under secondary recovery (waterflood or solvent flood). Last and not least, the field's operator must be ready to embrace a different way of producing new or mature fields. "The question is," says Baiton, "do we have the wherewithal to get companies to step up to the plate?"

Baiton's search for the ideal candidate field (and operator) is guided by optimism, and tempered with patience and a sense of humour. He describes the four-stage process that companies go through when introducing a new technology or patent: 1) it's a new idea that receives strict rejection; 2) reviewers say "we looked at it and didn't think that it was applicable without a complete investigation;" 3) reviewers say "we think that it has been done before;" and 4) final acceptance by industry.

According to Baiton, Vertizontal is at stage two. "Perhaps I'm ahead of my time," he says. "Looking into the future, Vertizontal will be used, without a doubt." NTM

— Susan Eaton

CONTACT FOR MORE INFORMATION

Nick Baiton, Vertizontal Energy, Tel: (403) 233-0002, E-mail: nbaiton@vertizontalenergy.com